'BLACK BOXES' FOR VEHICLES RAISE PRIVACY CONCERNS

THE ORLANDO SENTINEL

"Black boxes" for cars, a technology borrowed from the airline industry, now are poised to help auto-accident investigators pin the blame on drivers responsible for causing crashes.

Since 1990, many General Motors and Ford cars and trucks have been equipped with a device similar to an airliner's black box, or flight data recorder, which automatically records the vehicle's speed, throttle setting, braking effort and engine rpm for each of the five seconds leading to an air-bag deployment.

Until now, however, it was difficult to extract that information from the car's air-bag control module.

But a California company in March began selling a device that connects a car's onboard computer to a laptop computer to extract such key information quickly from a crashed vehicle.

The $2,500 device - called a Crash Data Retrieval System - is being marketed by Vetronix Corp. of Santa Barbara, Calif., to police forces, insurance companies and auto-rental agencies to help them reconstruct crashes to determine fault.

"The system lets investigators collect objective, accurate data on crashes to enhance reconstruction [of accidents)," said company president Jim Zaleski.

Some of the vehicles also can tell investigators whether the occupants were wearing seat belts and whether the passenger-side air bag had been deactivated.

Most of the data that the system gives to crash investigators isn't new - such information has been used for decades to reconstruct accidents, said Phil Haseltine, president of the Automotive Coalition for Traffic Safety, an auto-industry group.

But investigators have had to gather the information using other sources, such as tire skid marks. Now they can get it from the vehicle's onboard computer.

"This technology isn't measuring anything new, but it is measuring it more accurately than in the past," Haseltine said.

"On the engineering side, it will help the design engineer find out whether safety systems work as well in real crashes as they do in laboratory crash tests. I predict we will see crash-data recorders used by more automakers as they install more advanced air-bag systems."

But Haseltine and others, including officials at GM, say there are privacy issues that have kept the technology from advancing as rapidly as it could have.

The data that a police investigator or insurance adjuster extracts from the car's air-bag control module could be translated into hard evidence for use in the prosecution of a driver who is at fault in an accident, or for use by plaintiffs in lawsuits over such accidents, critics warn.

Vetronix says it is in negotiations with the California Highway Patrol to provide the devices to its officers, and the company plans to market the system aggressively to police agencies and insurance companies nationwide.

"The capability to use this information in an intrusive manner is there, and we should all be vigilant to make re nobody tries to do that," Haseltine said. "Manufacturers aren't putting these systems in vehicles with the intention that just anyone would be able to access the information.

"Giving the technology to police investigators is a gray area," he said. "If a judge orders it in a court case, it can eventually wind up in court. But it's likely that we will only see that in very serious crashes with expensive litigation. I can't imagine using it for every little fender-bender."

GM has a "strict policy that the data belongs to whoever owns or leases the vehicle, and it won't be accessed without their consent," said Terry Rhadigan, the automaker's safety spokesman.

But Vetronix promotes the system as something investigators can use almost immediately, at a crash site, to download the information, and there are concerns that such a situation might preclude getting a vehicle owner's permission.

The impetus to record this information to aid crash investigators came from the National Transportation Safety Board, which recommended in 1997 that automakers develop onboard collision-sensing and recording devices.

The NTSB has required that such equipment be installed on most modes of public transportation, including airliners, buses and trains. But this is the first time the technology has been extended to private passenger cars.

So-called recordable air-bag modules have been installed in many GM vehicles since 1990, but it has been only recently that the data from an air-bag deployment or near-deployment could be easily downloaded for use by investigators.

"There is value to this data," GM's Rhadigan said. "The more we know about how our vehicles perform in the al world, the more we can improve them. It's another way to aid in accident reconstruction, along with eyewitness reports."

At present, the Vetronix system is designed to download the information only from late-model GM vehicles, and Vetronix has obtained rights from GM to market a system to retrieve the data from those cars.

Those vehicles include the 1998 Buick Park Avenue and most '98 Cadillacs; most 1999 Buicks and Cadillacs, the Chevrolet Corvette and Camaro, and the Pontiac Firebird; and nearly all 2000 model Buicks, Cadillacs, Oldsmobiles, Pontiacs, Chevrolet cars and trucks (including sport-utilities), GMC trucks and sport-utilities, the Isuzu Hombre pickup, and the Saturn S-series cars.

Other manufacturers, including the Ford Motor Co., have air-bag control modules that record the same information. Vetronix says its system can be adapted to read the data from the other manufacturers' vehicles as soon as those automakers release the technical data necessary to develop the retrieval software.

Vetronix also plans to develop software in concert with GM to retrieve the data from air-bag-equipped GM cars dating to 1990, company officials said.

For $2,495, Vetronix provides the crash data retrieval module and Windows-based software, along with the necessary cables to connect the device to the vehicle and a laptop computer.

The software puts the data into graphs that can be printed out, showing the speed and other data for each of the five seconds preceding the air-bag deployment.

"The potential impacts of this product are immense, since about 18,000 tow-away crashes occur daily,' Zaleski aid.

For now, the system is tied to the air-bag activation computer, and manufacturers such as GM don't see the technology evolving into a full-scale black box setup like that used in airliners, Rhadigan said.

"We see the automobile system used in just this air-bag application," Rhadigan said.

"We don't ever want people to think we're going to get to the point where we record conversations and other things that occur in airplanes. Those are pretty sophisticated devices."

Suzuki to pursue U.S. court battle over Samurai

TOKYO, May 26 (Reuters) - Japan's Suzuki Motor Corp <7269.T> said on Friday it would appeal after a U.S. federal judge threw out its lawsuit over a magazine articl that said its Samurai sports utility vehicle was prone to rolling over on hard turns.

Japan's top minicar maker said it would pursue its battle with the publishers of Consumer Reports over the article by filing an appeal to the Ninth Circuit U.S. Federal Appeal Court.

In April, 1996, Suzuki Motor sued the publisher of Consumer Reports magazine, charging it rigged a test in 1988 that showed the Samurai vehicle was prone to fatal tipping accidents.

"It is regrettable that a federal judge threw out the lawsuit. We will persist with fighting (Consumer Report) in the Federal Appeals Court," a Suzuki spokesman said.

In September 1988, the National Highway Traffic Safety Administration (NHTSA) decided not to conduct open investigations into the alleged safety problem of the Samurai multipurpose vehicle sold by Japan's Suzuki Motor. Suzuki is owned about 10 percent by General Motors Corp .

Judge throws out Suzuki lawsuit against magazine

LOS ANGELES, May 25 (Reuters) - A federal judge on Thursday threw out a lawsuit by Suzuki Motors against the publishers of Consumer Reports over an article which said the Samurai sports utility vehicle was prone to rolling over on hard turns.

U.S. District Judge AliceMarie Stotler ruled that Suzuki<7269.T> had failed to prove by "clear and convincing evidence" that Consumer's Union acted with malice when they called the Samurai dangerously unsafe in a July, 1988 article.

Suzuki had sued the publishers of America's best-known product testing magazine in U.S. District Court in Santa Ana, Calif., for product disparagement and defamation, seeking unspecified damages.

A representative for the Japanese automaker could not be reached for comment on the decision on Thursday.

"We're thrilled," said Consumer's Union lawyer Joseph Cotchett. "It is absolutely clear to me that Suzuki's case was without merit and they knew it. The case was designed solely, in my opinion, to harass Consumer's Union."

Cotchett said Stotler's ruling confirmed what that "there is absolutely no malice on the part of these people."

The Suzuki case was a companion to the product disparagement and defamation case filed against Consumers Union by Isuzu Motors <7202.T> over an October, 1996 article that said the 1995-96 Trooper had a propensity to roll.

After a two-month trial in U.S. District Court in Los Angeles, a 10-member jury found that Consumer Reports made false statements about the safety of the Trooper, but in a mixed verdict refused to award the automaker -- whose lawyers claimed some $240 million in damages -- a single penny.

Both sides, which spent millions of dollars on a case that was closely watched by both the auto industry and

Car companies, the Internet and information

Posted by Steve C on 2000-03-18 07:43:58:

Recently I was part of a group that talked with one of the large mostly US car companies about their Internet plans. Much of it is still under development, but bits and pieces have been reported in the news.

What is truly stunning is that they are interested in making a close connection with the customer and having that connection for a long period of time - preferably inspiring repeat sales. They are attempting to make internal decisions "crisp" and actually listen to customers through BBSs, email and webpages. Everyone talks about this, but consider the handling of various TT issues over the past year.

They hope to reduce car lot inventory (which is very expensive for them) and want to encourage people to order cars. The feeling is that if a car can be built and delivered in under two weeks (of course this is all on one continent), the customer may take a vehicle with the options s/he wants rather than something that has been sitting on the lot for 5 months. They seem to have fundamentally changed their model of selling the customer something that the car company want them to have to something that the customer really wants. A quote is "WE can't force an option package on the car owner in the future. It will grate on them every day and will impact their decision to change brands in the future. It is important that they get exactly what they want so they will be happy with their purchase."

They are talking about doing this with some of their models in the 2003 model year - very swift for something as massive as a car company.

So you will order a car to your liking (this might even be done from your PC) and a secure webpage will be created showing status during production. On the build day digital cameras at most of the build stations will take pictures of the assembly process and populate your page with the creation of your car (lots of jokes about the car worker putting the coke bottle in the gas tank and getting caught on camera:-) Any change in status of your car will be reflected on the page in "a few minutes."

Your secure webpage will be a repository for all of your links into their world. They are claiming that their execs will be forced to pay attention to the collective signal and that planning and execution will have to undergo a fundamental change in their industry.

There are lots of features that involve Net connections to the car that I won't go into, but these guys clearly have a more sophisticated view than is shown at CES and other shows.

They kept making the point that this is going to be very difficult for them - the social issues are much more difficult than the technical issues here - but to survive in the new economy they have to do this. They also feel that much of their competition will find this an even more difficult task. In particular the

European competition due to a common "centralized and dictatorial" management style and inefficient production model."

It was very difficult to sit on my hands and not comment on the poor quality of information from Audi (which is probably how they found themselves in a crisis mode with the TT in the first place). The dealers are cut off from the decision process and get information later than the customers. Many of the customers are enabled by the Internet and quickly spread information and mis-information with little or no ability to judge which is which (this probably makes Audi look worse than they really are). Here is a company that can't even tell you when you will take delivery when your car is on the dock (as mine is now -- I'm hearing anything from a few weeks to the end of May).

There are clearly many people in Audi who want to do the right thing for the customer (I have run into a few who are excellent), unfortunately the information and management structure of the company seems to get in the way.

A final note -- the meeting we had ended with a very high level person from their company saying "In the 20s Henry Ford knew that the consumer only wanted black cars. This insight on is part damaged his company for decades. The consumer now knows what she wants and part of that is information from us. Many marques are deeply endangered and have no idea what is going to hit them."

One has to wonder how and when (and possibly if) Audi will make the change to including the customer in the information chain. They make fine cars IMHO, but the world is now expecting more.

Tracking:

June 6, 2000

DRAFT OUTLINE FOR EDR WG FINAL REPORT

Introduction (Item Order Not Final)

- ✔ Public Documentation Process
- ✔ Meetings
  - October 2, 1998
  - February 17, 1999
  - June 9, 1999
  - October 6, 1999
  - February 2, 2000
  - June 7, 2000
- ✔ Objective of Working Group
  - Facilitate the Collection & Utilization of Collision Avoidance and Crashworthiness Data from On-board EDRs.
- ✔ Participants (Members and Non-members)
  - List of Participants with Company Names, Phone Numbers, Etc.
- ✔ Objectives of the EDR Working Group
  - What Is the Status of EDR Technology?
  - What Data Is Needed for Recording?
  - How Is the Data Collected & Stored?
  - How Is the Data Retrieved?
  - Who Is Responsible for Keeping the Permanent Record?
  - Who Owns the Data?
  - Who Are the Customers for EDR Data?
  - Demonstration of EDR Technology.
- ✔ Fact Finding Effort

Background

- ✔ NHTSA Activity
- ✔ NTSB Recommendations
- ✔ JPL Recommendations
- ✔ Petitions for EDR Rulemaking
- ✔ ATAs Activities Under TMC
- ✔ Other History

EDR Technology
Data Elements
Data Collection & Storage
Data Retrieval
EDR Permanent Record
Privacy and Legal Issues
Customers of EDR Data
EDR Demonstration

Summary and Findings

TMC Recommended Practice

Proposed RP 1212 (T) **VMRS 045**

PC TO USER INTERFACE RECOMMENDATIONS FOR ELECTRONIC ENGINES

TABLE OF CONTENTS

PREFACE

The following Recommended Practice is subject to the Disclaimer at the front of TMC's *Recommended Engineering Practices Manual.* Users are urged to read the Disclaimer before considering adoption of any portion of this Recommended Practice.

1. INTRODUCTION

1.1 PURPOSE

Fleets and dealerships need service tools and software programs that are easy to use and have a common look and feel. Technicians must be able to

use electronic engine service tools and software with a high degree of confidence, and training should be simple and fast. Lastly, equipment users and dealerships need common vehicle and operation security. The purpose of this Recommended Practice is to meet these needs by establishing user interface guidelines for the development of service tool software used on commercial vehicles.

This Recommended Practice addresses security, terminology, and functionality standardization. These guidelines should help suppliers provide a similar look and feel to all service software packages, so that technicians are comfortable with both the functionality and location of various tasks within the software, and the terminology used to describe the tools.

1.2 SCOPE

This RP applies to service tools and software packages used to diagnose, program and repair electronic engines used on commercial vehicles.

1.3 OVERVIEW

To achieve commonality, common tasks under common headers must be defined. Passwords should have a set number of minimum and maximum alphanumeric characters. Additionally, previous engine electronic control unit (ECU) changes should record the tool identification and technician logon. Passwords and logons should be placed in a common location under common headers to make the audit trail easy to locate.

1.4 REFERENCES

- TMC RP 1203, *Vehicle Electronics Glossary of Terms.*
- SAE J2403, *Medium/Heavy-Duty Electrical/ Electronic Systems Diagnosis Nomenclature*

2. TERMINOLOGY

2.1 DEFINITION OF TERMS

TMC believes that terminology standardization can be best achieved through adoption of TMC RP 1203 and SAE J2403. Developers are encouraged to use the terminology established in these standards in place of colloquialisms or other terminology currently used by various engine companies and suppliers. In this way, parts specialists, engineers, production and fleet personnel can develop a common understanding of the terminology, thereby reducing miscommunication.

3. PASSWORD GUIDELINES

3.1 COMMON PASSWORDS FOR USER FUNCTIONS

Passwords for electronic engines today serve the same security function as the mechanical security seals on nonelectronic engines once did. In the past, each mechanical seal carried symbols or wording which helped determine whether an engine's adjustable features had been altered. As with mechanical seals, password protection often cannot identify *who* actually changed the preset engine parameters.

Therefore, the following outline is given as a recommended security system which allows for (1) necessary clearing of codes, (2) reading of parameters, and (3) programming of user functions without jeopardizing the security of a company's established parameters. It also provides an audit trail to determine what parameters were changed and which tool identification was used to make these changes. Once the tool is discovered, the individual who made the changes can be identified—provided the steps outlined in this RP are followed correctly.

3.2 LOGON ID – APPLICATION SOFTWARE

The logon ID and password reside within the application software. They're used to identify individuals either changing parameters or servicing engine ECUs. It should be necessary to enter this logon ID and password prior to opening the diagnostic software program. TMC recommends that there be three levels of passwords:

- System Administrator.
- Supervisor.
- Technician.

A system administrator at the user level would assign the logon ID and password. An example of the System Administrator would be the Director of Maintenance or company designee within the maintenance department.

3.2.1 System Administrator Password

The System Administrator password should allow the System Administrator to use all functions of the diagnostic program and install or remove records pertaining to logon ID's, work orders, programming templates, various engine options and parameters.

The System Administrator must assign the logon ID and password for all users of the system, assign

Supervisor or Technician authority to those users, and determine features within the software that are available to the Supervisor and Technician level. Higher levels of passwords should automatically assume the functions of all lower level passwords.

The System Administrator password should be in possession of the System Administrator and key upper maintenance management only. The System Administrator password should reside in the application software.

3.2.2 Supervisor Password

The Supervisor password should permit all functions of the diagnostic program except the clearing of historical records and the assigning of the various ID passwords. The Supervisor password should not permit the changing of the System Administrator password.

The Supervisor password should permit programmable changes to be accomplished without going back to the System Administrator each time an ECU needs to be updated or reprogrammed. The Supervisor password will reside in the Application Software and will be assigned by the System Administrator.

3.2.3 Technician Password

The Technician password should permit the user to read and clear fault codes, and read diagnostic functions within the diagnostic program. The System Administrator could assign various other duties normally performed at the supervisor level. These assignments would be based upon the technician's abilities and the level of trust that the System Administrator has in the technician. These various levels of abilities should reside within the Application Software and be controlled by the logon password. These options in the application software should match the ECU software. The technician password should reside in the application software. It is imperative, therefore, that when additional duties are assigned to a technician, that the technician must use diagnostic tools that have been configured with his/her logon password and authorized functions.

3.3 USER PASSWORD LOCATION

All application software should begin with a logon screen that requires the user to enter their logon name and their associated password. This allows the user to accomplish all security checks prior to doing any work. If no name/password is entered, the program should function in a "read only" mode and not allow any changes to be made within the ECU Should the technician decide that changes need to be made after reading the ECU information, he/she should be allowed to go back to the security screen to enter necessary security measures without closing the program.

3.4 ECU PASSWORDS

3.4.1 Customer Password

The ECU should have a Customer password that can be changed by a System Administrator. This password should enable ECU reprogramming, fault code clearing, and ECU record clearing. The Customer password could be the same as the System Administrator password. Access to the various functions allowed by this password should be controlled in the application software according to the level of the logon password, (i.e. Supervisor or Technician).

3.4.2 OEM/Manufacturer Password

This password should not be made available to end users. However, there are certain things about the use of this password that need to be covered in this Recommended Practice. The OEM/Manufacturer password should have access to all functions of the ECU including those assigned as user parameters. Use of this password should be logged and an audit trail of the last three events kept in the ECU.

OEM/Manufacturers should make available to the end user records of any changes to their parameter settings or programming. The issuing of this password to a dealership should automatically initiate a written notice to the end user that the password had been used and program parameters may or may not have been changed. This would require an administration process at the OEM/Manufacturer level to ensure that certain information is gathered before the password is given to the dealership (i.e. Current Owner Information, Speedometer Reading, and Serial Number).

All OEM/Manufacturer passwords should be self-canceling. The method of self-canceling is up to the OEM/Manufacturer.

3.5 Application Software/ECU Password Relationship Overview

To illustrate the envisioned relationship between the Application Software Password and the ECU Passwords, refer to **Figure 1**:

As shown in **Figure 1**, the Application software

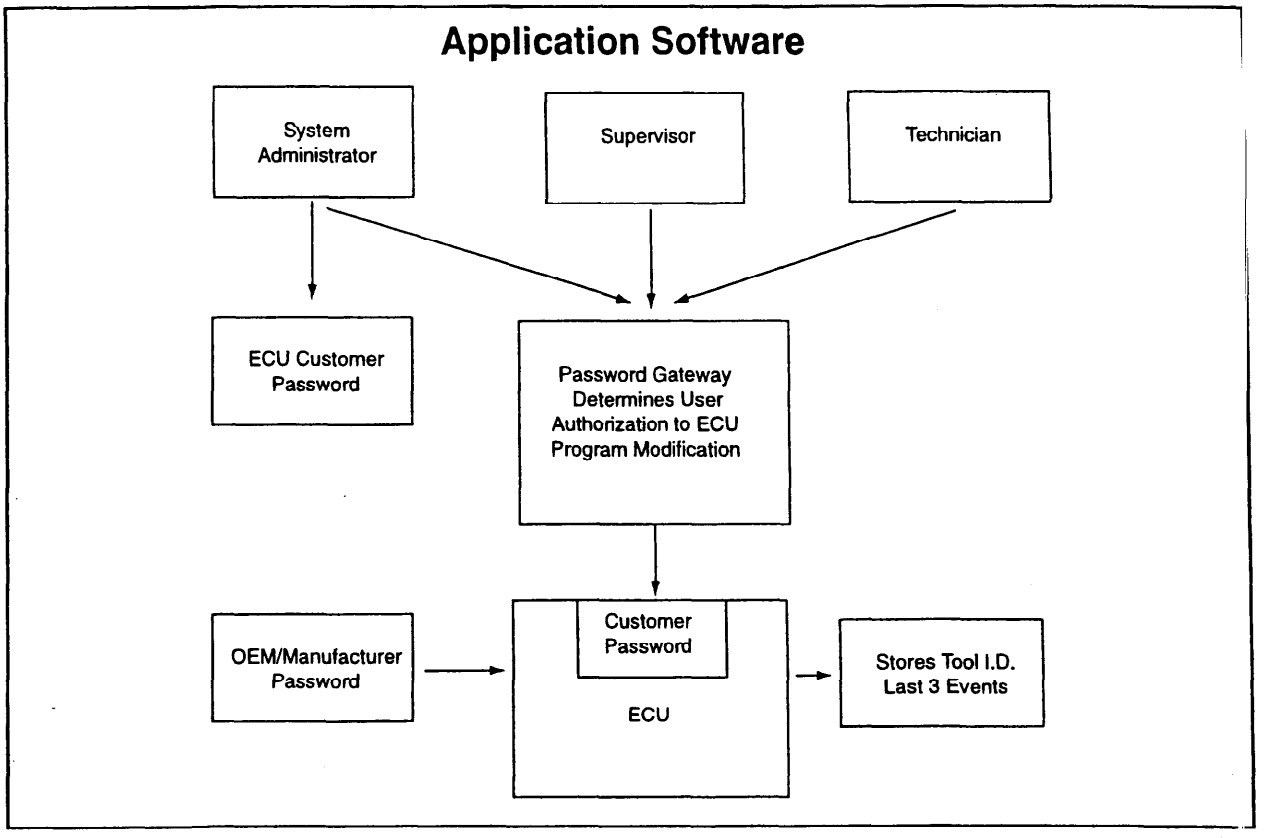

Fig. 1

manages access to the Customer password stored in the ECU. The System Administrator can set or modify the Customer Password in the ECU, as well as create user profiles with various authorities within the core Supervisor and Technician levels of authorization of the system. There is an OEM/Manufacturer password that is not used for general diagnosis, and use of this password should be reported to the end user as described in **Section 3.4.2.**

3.6 Password Specifics

All security passwords should exhibit the following characteristics:

- Alphanumeric only – with no symbols.
- Write to upper case.
- Read to upper and lower case.
- No password will be allowed to be case-specific.
- Passwords should be left-justified
- Fields not used by password should be filled by the application software with ASCII spaces decimal 32, hexadecimal 20. This action will not be observed by the end user.
- Due to global concerns, password field length should be 10 characters.
- The user may enter any number from zero to 10 characters as their password in the application software.
- The manufacturer, while allowing a 10-character entry, would be able to limit the password length by choosing to use any of the characters from four to 10 in number. This limitation should reside in the ECU.

4. SOFTWARE TEMPLATES

The application software should allow the System Administrator to create vehicle templates that contain desired parameters for all similar vehicle ECUs. These templates can then be distributed to the field, allowing programming of several vehicles without direct System Administrator involvement in each vehicle programming event.

5. AUDIT TRAILS

Since diagnostic tools cannot at present communicate with each other—and since these tools are often scattered among different repair facilities—audit trails must reside both in the Application Software and the ECU. The following two sections define the recommendations for each.

5.1 ECU

Upon an ECU parameter change, the ECU should:

- Store the tool software ID.
- Flag, not maintain, parameter changes:
  - Speed
  - H/P – Torque
  - Customer Settings
- Record the last three software IDs.
- Record date, time and engine hours.

The ECU should maintain these records for the last three ECU programming events.

NOTE: TMC recommends that all vehicle owners replace their ECU security passwords with "0000" at the time the vehicle is removed from service. This should be done in order to preserve your password security and allow the next owner to install their security without the added expense of removing previously installed security measures.

5.2 APPLICATION SOFTWARE

Upon an ECU parameter change, The application software should record the following items:

- Login ID.
- VIN.
- Parameter changes.
- ECU change outs.
- Fault codes at login.
- Fault codes at logoff.
- Event date.
- Engine ID.

The Application Software should be able to store multiple records, the only limitation being the size of the hard drive on the host PC where the Application Software resides.

The Application Software should include maintenance utilities that allow a System Administrator to configure the number of records to be stored on the PC Hard Drive before prompting for a backup of records or purge of the event database. An example would be that the system would maintain the last 150 records, and prompt the user to backup the records to other media (such as floppy disk), at which time the records would be purged from the PC hard disk. It should be noted that the Application Software should never arbitrarily delete records without System Administrator (or Supervisor if the System Administrator has authorized this action at the Supervisor Level) authorization.

6. FUNCTION GROUPING

To reduce confusion among technicians working on various electronic diagnostic programs, software designers should consider common groupings of software functions. This would allow technicians to be proficient in diagnostic software for which they haven't been fully trained. Function grouping would increase shop productivity and reduce misdiagnosis and rework. A flag should be given to technicians in cases where settings of one parameter affect another parameter setting within a different grouping. This flag should tell the technician the parameter being affected and the grouping where it is found.

TMC recommends the following configuration of groupings for cataloguing all features of engine diagnostic software. The functions listed under the groupings should be considered as examples of features within the grouping. The examples should not be considered as the only features within the grouping. It will be up to the individual engine manufacturer and software provider—in conjunction with TMC's VMRS Codes Committee—to determine under which grouping the feature should be listed. TMC recommends that these manufacturers check to see if their feature has already been catalogued into a grouping in order to ensure that the features stay within the same grouping.

6.1 GROUPING CONFIGURATION

6.1.1 Engine Design Configuration

- Engine model.
- Engine serial number.
- ECU serial number.
- Software level.
- Engine horsepower.
- Engine RPM.
- Peak torque.

6.1.2 Fault Codes

- Active.
- Inactive.
- Clear codes.
- Code description.

6.1.3 Vehicle Specs

- Tire RPM.
- Rear axle ratio.
- Top gear ratio.
- Teeth on speed sensor ring.
- VIN number.

6.1.4 Engine Current Configuration

- Horsepower.
- Torque.
- Maximum RPM.
- Idle speed.

6.1.5 Management Reports

- Trip data.
- Engine hours.
- Total gallons.
- Idle hours.
- Idle fuel.
- Graphs.

6.1.6 Driver Controlled Features

6.1.7 Test

- Cylinder cutout.
- Response times.
- Calibration.
- Hydrocarbon test.

6.1.8 Management Controlled Features

- Driver incentive.
- Driver password.
- Co-Driver password.
- Theft deterrent.
- Engine start/shutdown.

7.0 INCIDENT EVENTS DATA

This category is to be used for information gathered during an event. The information, once logged into this category, should only be accessed by the use of a special password. This password should be different from all fleet or OEM passwords and must reside within the ECU. This allows the use of any diagnostic tool with the proper programming to access the information by using the proper password. This password should be assigned by the System Administrator. Anyone wishing to access information contained in this incident event category must first obtain the password from the system administrator. Refer to **Section 3.6** for password specifications.

Incident events data might include the following:

- Battery voltage.
- Engine throttle status.
- Engine RPM.
- Vehicle mileage.
- Vehicle ID number.
- Vehicle speed.
- Time and date.
- Deceleration rate.

NOTE: TMC does not intend that any of the items listed above should be placed in the incident event category. They are merely examples of what might be found in this category.

Only engine manufacturers possess all of this information on their products and, because gathering procedures may differ between models, engine manufacturers must be involved in determining whether the data is pertinent to the incidents being investigated. It should be up to engine manufacturers to decide what data will be stored in this category.

The information contained in this category will retain the last three incidents for each event category in order to ensure that all available ECU information needed to aid in incident reconstruction is recorded. Due to the need of having information from other ECUs on the vehicle, all information should be obtained through the datalink supplied by the OEM. This permits access of all ECU incident event data. Use of data contained within the engine ECU may not supply the data needed to get an accurate picture of the events that occurred during an incident. Therefore, TMC recommends that all ECUs be polled for the incident event data before any conclusions are made concerning incidents.

Crash Survivable Module

For

Trucks and Busses

BACKGROUND

SI-IMS is the Information Management Systems Division of Smiths Industries, Plc. This division is headquartered in Grand Rapids, Michigan.

We are an established developer and manufacturer of aerospace products with over 50 years of manufacturing experience. These products include digital and analog systems for navigation, weapon delivery, guidance and control, and aircraft performance management and recording. Our systems are on fighter and multi-engine aircraft, drones, missiles, launching platforms, helicopters, RPVs, radar subsystems, ships, space vehicles, tanks, and torpedoes.

SI-IMS is a world leader in the design, development, and production of solid-state crash survivable flight data recorder systems. Starting in 1984 with the competitively awarded Crash Survivable Flight Data Recorder (CSFDR) for the F-16 *"Fighting Falcon,"* through the sole source derivative, the U S Air Force (USAF) Standard Flight Data Recorder (SFDR), to our latest data recorder systems - the combined Voice and Data Recorder (VADR®), the Integrated Data Acquisition Recorder (IDAR) the Health Usage Monitoring System (HUMS), and the Voyage Data Recorder (VDR) for ocean going vessels, SI-IMS has continuously expanded and made improvements to the initial recorder systems. The Grand Rapids site, which has developed and produced these recorder products and systems, employs approximately 1,000 people, including more than 600 professional technical personnel.

CRASH SURVIVABLE RECORDER FOR TRUCKS AND BUSSES

Whether the vehicle is an aircraft, ship, spacecraft, or ground vehicle, the crash survivability specification should be derived from the crash environment that the vehicle is likely to encounter in an actual mishap. Crash survivable recorder design history tells us that the sequence of events during an actual mishap can be

- Impact shock
- General shock
- Penetration (punch through)
- Static crush (deadweight)
- Fire, and
- Water immersion.

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These are the parameters to which the Crash Survivable Module (CSM) must be tested. Our initial determination of values for these parameters, as they relate to trucks and busses, is presented in the following section.

As in the case of other types of vehicles, a determination must be made of the truck and bus parameters that need to be recorded in order to reconstruct the accident profile via a dedicated software package. This permits an analysis of the mishap and determination of the causal factors. Our initial determination of parameters that need to be recorded, as they relate to truck and bus mishaps, is also presented in the following section.

CRASH ENVIRONMENT AND PARAMETERS NEEDED FOR TRUCKS AND BUSSES

Survivability parameters follow a logical sequence of events resulting from a crash for any type of vehicle. For an aircraft, the initiating event is the impact of the airframe with the earth's surface. Two scenarios can follow at this point; a land impact or a water impact. The survivability parameters are specified in order of occurrence and must also be tested in that order. For an aircraft these are:

1. Deceleration: 3400 G's with a time duration of 6.5 Milliseconds. This represents the initial impact. The test is required to be in the direction to which the CSM is most at risk for damage.

2. Penetration: A ¼" diameter pin driven by a 500 pound weight dropped from a height of 10 feet. This represents debris following the CSM into the impact, which is driven by the mass of other portions of the aircraft. The pin represents a bolt or sheared structural member, but may be any sharp corner or edge of the debris. The test is applied to 3 mutually perpendicular faces of the CSM.

3. Static crush: A dead weight of 5000 pounds is applied diagonally across each of the 3 major axes of the CSM for a period of 5 minutes. This represents a major aircraft element, such as an engine core, resting on the CSM.

At this point, the standard differentiates between a land impact and a water impact.

4. For a land impact, the next test is a high intensity fire. The standard requires a 1-hour exposure to a fire with a flame temperature of 1100 degrees C having an intensity of 50,000 BTU/Hour. This represents the fire from aircraft on-board fuel.

5. The final land impact test is a 10 hour, 260 Degree C, low intensity fire. This test is required because both high and low intensity fires have been experienced in actual aircraft crashes.

A water impact does not require the fire, but instead substitutes a 30-day seawater soak at a pressure equivalent to a depth of 20,000 feet. The standard does not require that the CSM assembly be watertight if it can be shown that the storage media is immune to the salt water and pressure exposure.

CSM survivability for trucks and busses

In general, the sequence of events described for aircraft will also apply to truck and bus mishaps. The differences in the requirements will be in the magnitude of those requirements. A proposed set of test levels and the rationale for those levels follows. They are presented with the aircraft level requirements for comparison.

Crash Impact Requirements Comparison

Parameter	Airborne (ED-56A)	Trucks/Busses
Impact shock	3400 G, 6.5 m Sec	300 G, 50 m Sec
Penetration	0.25" pin, 500 Lb, 10 ft	0.50" pin, 200 Lb, 3 ft
Deadweight	5000 Lb on diagonals	500 Lb on diagonals
High Level Fire	1100 Deg. C., 1 hour	900 Deg. C., 20 min
Low Level Fire	260 Deg. C., 10 hours	260 Deg. C., 5 hours
Water soak	20,000 FT, 30 days	100 FT, 10 days

Impact shock: Information supplied by General Motors and based on their testing of large trucks indicates that a truck traveling at 35 MPH and hitting a solid barrier will experience about 40 G's for a period of 50 milliseconds inside the cab. Extrapolating this to a speed of 70 MPH gives a value of 160 G's. Since this may represent more of an average or nominal value, it is doubled to get to a worst case scenario.

Penetration: Changed to represent lower total mass drivers, shorter distances, and a penetration pin size that is closer to the components found in a truck structure.

Deadweight: This number is reduced to 500 pounds, a value that represents singular high mass elements of the vehicle such as the engine/transmission or an axle/differential assembly.

High Level Fire: The intensity is reduced slightly. The aircraft based requirement assumes accelerants such as oxygen from crew or passenger breathing systems and/or structural elements of magnesium, neither of which are common in trucks or busses. The time interval of the fire is reduced, recognizing that substantially less fuel is on board.

Low Level Fire: The time duration is reduced but not the intensity. The post high level burnout condition and cool down will likely behave in a manner similar to an aircraft fire but without the total mass in the wreckage that an aircraft would have.

Water immersion: Both depth and time duration are reduced. Truck or bus wreckage into water is extremely unlikely to involve deep water or to be undetectable and remain there for any long period of time.

The analysis above does not take into consideration any cargo that may be present in trailers or the cargo section of a truck. As it affects the survivability of a CSM, the cargo can be examined in three categories. They are:

1. Total mass. This affects the CSM survivability from the standpoint of crush resistance and may contribute to extend the low temperature fire duration. Examples of this are: lumber and building products, brick and concrete.
2. Density. This affects the penetration resistance and, in combination with total mass, further affects crush resistance. Examples are: Steel plate, rod, bar, pipe, or other metal stock.
3. Flammability. This affects high temperature fire duration. Examples are propane or gasoline.

If the cargo is the right type or is large enough, the CSM survivability parameters begin to approach the aircraft levels with the exception of the impact shock. An additional issue for tractor-trailer vehicle configurations is the behavior of the cargo at the time of impact. If the incident is a straight-line event, the cargo certainly becomes part of the survivability consideration. If, however, the impact includes a rotational component (jackknife), then the cargo passes by the CSM portion of the crash event and does not interact or add to the CSM survivability issue. The degree of cargo interaction with a crash event is a subject for future study.

It should be recognized that no specification can provide a definition of a true "worst case" scenario without reaching very large magnitudes for survivability requirements. The aviation based requirements still come up short for some crash events. A level of information recovery from a crash event of slightly less than 100% can be expected for a cost-effective design.

Vehicle data recording

The selection of parameters which can be used to reconstruct an incident are in 3 major categories. They are:

1. Operator commands and control inputs
2. Vehicle responses and actions
3. Environmental information

Operator commands and control inputs

1 Steering
2. Braking
3. Accelerator
4. Warning signals (horn, lights)
5. Transmission

Vehicle responses and actions

1. Speed
2. Acceleration components (X and Y)
3. Radar forward and side closing rates (if available)
4. Braking response
5. Engine speed and response
6. Other vehicle and engine status

Environmental information

1. Temperature
2. Vehicle location (if GPS equipped)
3. Other weather related.
4. Ambient lighting

These parameters can be collected by suitable on-board electronics and stored in a CSM. The tabular list which follows, identifies the parameter, accuracy required, and data rate at which the parameter should be collected and stored.

Operator commands and control inputs

Parameter	Range	Accuracy	Update Rate (HZ)	Bits	Total Bit Rate
Steering wheel	3600 degrees	1 degree	10	13	130
Throttle position	0-100%	10%	5	4	20
Brake petal pressure	0-100%	10%	5	4	20
Air brake pressure	0-200 PSI	20 PSI	5	4	20
Horn	Binary		5	1	5
				TOTAL BITS/SEC	195

Vehicle responses and actions

Parameter	Range	Accuracy	Update Rate (HZ)	Bits	Total Bit Rate
Vehicle speed	0-100 MPH	1 MPH	5	7	35
Engine speed	0-4000 RPM	100 RPM	5	9	45
Transmission gear	1-20	1	1	5	5
Engine (Note 1)	as needed	10%	1	32	32
Warnings (Note 1)	Binary		1	8	8
Forward radar	0-200 FT	1 FT	5	8	40
Left radar	0-200 FT	1 FT	5	8	40
Right Radar	0-200 FT	1 FT	5	8	40
X,Y acceleration	+/- 2 G	20 mG	10	20	200
				TOTAL BITS/SEC	445

Environmental Information

Parameter	Range	Accuracy	Update Rate (HZ)	Bits	Total Bit Rate
Temperature	-20/+120 Deg. F.	5 Deg F.	1	5	5
Location (GPS)	Global (segmented)	100 meters	1	32	32
Other (note 1)	As appropriate	5%	1	10	10
				TOTAL BITS/SEC	47

Note 1: Multiple parameters can be packed and multiplexed into the same storage word at a low effective data rate.

CRASH SURVIVABLE MODULE INTERFACING

The CSM is not, by itself, a functional element. It needs support from a microprocessor to provide low level management of data from a sensor suite. The data must be formatted to fit the structure of the CSM. Management overhead of the CSM includes erasing blocks of memory in advance of the need to write to them, determination of how the data maps to the physical structure of the memory, and in the case of event flagging, managing the continuous data recording function while maintaining the flag event data separately. The CSM may be hosted in a larger system, or may be a stand-alone function. Some tradeoffs are:

1: Smart Interface - RS-232 or RS-422 at 9600 baud

Advantages:

Stand-alone module.
Can be located anywhere in vehicle.
Manages low-level protocols into and from hardened storage element. (CSM)
Changes and upgrades do not affect core systems.
Download and recovery can be independent of core systems.

Disadvantages:

Requires enclosure and power source.
Requires cabling.

2: Imbedded CSM storage element only.

Advantages:

Integrated into other electronics, no separate enclosure.

Disadvantages:

System integrator must implement low level interface protocol in his processor.
Physical location may not be optimal for survivability.
May require higher level processing and/or a more complex microcomputer to handle the additional task load.

SUMMARY

The technology is available to make on-board recorders crash survivable for trucks and busses. A preliminary crash survivability specification has been developed by using procedures similar to those of the aircraft industry. With the state-of-the-art of the recorder industry, it is possible to design and produce a low-cost CSM that will hold the necessary parameters for mishap reconstruction via a dedicated ground support software package. We recommend that the Department of Transportation require that future on-board recorders, for trucks and busses, be designed to meet crash survivability standards.

TO: NHTSA EDR WORKING GROUP

FROM: Tom Kowalick

DATE: June 7, 2000

RE: Proposal to classify EDR's to achieve short-term & long term goals supporting Phase I, II, & II goals and objectives.

The mission of an Event Data Recorder (EDR) Program is to "enhance highway safety" by reducing highway crashes and resulting injuries and fatalities. The specific goals are short-term and long-term.

The short-term goal is to retrieve, gather, and store Type 1* parameter data elements. The accomplishment of this goal will accelerate deployment of driver-assisted technologies, collision avoidance systems, vehicle diagnostic systems and advanced medical response capabilities.

The long-term accomplishment will include retrieving, gathering, and storing Type II** data which will improve highway efficiency, mobility, productivity, and environmental quality by providing compelling evidence of the types of crashes, the role of human error, systems engineering and systems integration issues.

Both goals will encourage equipping motor vehicles with technologies that make the driving task safer.

Classifying EDR's and thereby segmenting goals will assist in rapid deployment to a large fleet and will overcome the obstacle of obtaining data from a large sample in a shorter time period

Every vehicle should provide Type I data.

CLASSIFICATION OF EVENT DATA RECORDERS (ED

Event Data Recorder (EDR).

An on-board device capable of monitoring, recording, and displaying pre-crash, crash, and post-crash data eleme from a vehicle, event & driver.

Use of EDR parameter data elements

The overall objective of utilizing EDR data is to increase the safety of our highway transportation system. Recor a more accurate assessment of events leading up to an accident (pre-crash), real time (crash) and analysis (post

Classification of Event Data Recorders (EDR's)

- **TYPE I**
- **TYPE II**

Establishing minimum parameter data elements

- **TYPE I = 6**
- **TYPE II = 6 +**

TYPE I parameter data elements

- ⇒ **TIME**
- ⇒ **LOCATION**
- ⇒ **DIRECTION**
- ⇒ **VELOCITY**
- ⇒ **OCCUPANTS**
- ⇒ **SEAT BELT USAGE**

TYPE II parameter data elements

- ⇒ **All TYPE I + OTHERS**

☐ Active suspension measurements ☐ advanced systems ☐ air bag inflation time ☐ air bag status ☐ air bag on/off switch position ☐ automatic collision notification ☐ battery voltage ☐ belt s status-service ☐ brake status-ABS ☐ collision avoidance, braking, steering, etc. ☐ crash pulse-longitudinal ☐ crash pulse-lateral ☐ CSS presence indicator ☐ Delta-V-longitudinal ☐ Delta-V heading ☐ engine throttle status ☐ engine RPM ☐ environment-ice ☐ environment-wet ☐ environment-temp ☐ environment-lumination ☐ fuel level ☐ lamp status ☐ location-GPS ☐ nu direction of force ☐ PRNDL position ☐ roll angle ☐ seat position ☐ stability control ☐ steering wheel angle ☐ steering wheel tilt position ☐ steering wheel rate ☐ time/date ☐ traction c transmission selection ☐ turn signal operation ☐ vehicle mileage ☐ vehicle speed ☐ VIN ☐ wheel speeds ☐ windshield wiper status ☐ yaw rate ☐ cruise control ☐ phone status ☐ br control ☐ suppression system status ☐ electric steering functional ☐ service engine soon lamp on ☐ throttle-by-wire ☐ ignition cycle counter ☐ tire pressure warning lamp on ☐ envir wheel drive

Training Seminar 2000

June 30th, 2000

Santa Barbara, California

Fess Parker's DoubleTree Resort

CDR Training Syllabus

Fess Parker's DoubleTree Resort – Santa Barbara, CA
June 30th, 2000

8:30 am Welcome –

- Overview of Vetronix
- History of GM and Vetronix
- Overview of the CDR System

- Question and Answer period

9:00 am How to use the CDR System –

- Two ways to access data
- Three ways to power up CDR interface module and SDM
- CDR software overview: entering VIN, graphs, tables, etc.
- CDR software tips, shortcuts, printing
- Overview of Help Files

- Question and Answer period

9:30 am SDM Overview (presented by Don Floyd of General Motors) –

- What is an SDM
- History of GM SDMs
- Why GM records crash data
- Why GM is now releasing this data

- Question and Answer period

10:15 am ***Break Time***

10:30 am SDM Data Overview –

- How SDMs gather and record data
- SDM data parameters and their limitations
- What we can look forward to in the future

- Question and Answer period

11:30 am ***Lunch Time***

1:00 pm Massachusetts State Police Project (Presented by Trooper David Noonan) –

- Presentation of CDR project

- Question and Answer period

2:15 pm ***Break Time***

2:30 pm Field Training: Downloading data from a vehicle –

- Demo DLC downloading
- Demo various techniques for accessing the SDM

- Question and Answer period

5:00 pm Closing Remarks

2000 **Training** **Seminar** Registration

Name_____ Company_____

Mailing Address_____

Phone_____ e-mail_____

Would you like to receive 7 ACTAR CEUs? Y N (if yes, ACTAR# _____)
(Please Circle One)

Training Seminar Fee- $195.00
(includes lunch and CDR certification)

Payment Method-

- Payment by Check (Enclosed)
- Payment by Credit Card: Visa/Mastercard/Discover/American Express
  (Please Circle One)

  Cardholder Name: _____
  (As Printed on Card)

  Card Number: _____

  Expiration Date: _____

  Customer Signature _____

Please mail or fax your completed Registration Form to:

Vetronix Corporation
Attn: James Kerr
2030 Alameda Padre Serra
Santa Barbara, CA 93103
(800) 321-4889 x3238
(fax) 805-965-3497
jkerr@vetronix.com

HOTEL INFORMATION

The 2000 CDR Training Seminar will take place at **Fess Parker's DoubleTree Resort** in Santa Barbara, California.

We have negotiated a room rate of **$159** for Thursday night, June 29th and **$219** per night for Friday and Saturday night, June 30th and July 1st. We have a limited number of rooms at this rate, so please make your reservation ASAP.

In the event that our reserved room block fills up, a corporate rate of **$199** for Thursday night, June 29th, and **$249** per night for Friday and Saturday night, June 30th and July 1st, will be available.

When making your reservation, be sure to mention that you are registering for the Vetronix CDR Training Seminar to receive the discounted room rate.

The DoubleTree Resort offers complimentary airport shuttle service to and from the resort. Travel time is only 15 minutes. The shuttle is available 5:00 AM – 11:00 PM daily.

For reservations, please call **(805) 564-4333**.

Address-

Fess Parker's DoubleTree Resort
633 East Cabrillo Boulevard
Santa Barbara, CA 93103

www.fpdtr.com
(800) 222-TREE

More Hotel Options-

Cabrillo Inn
(805) 966-1641
931 E. Cabrillo Blvd.
Santa Barbara, CA 93103
(1/2 mile away)

Room Rates: **$109** (June 29th)
$149 (June 30th and July 1st)

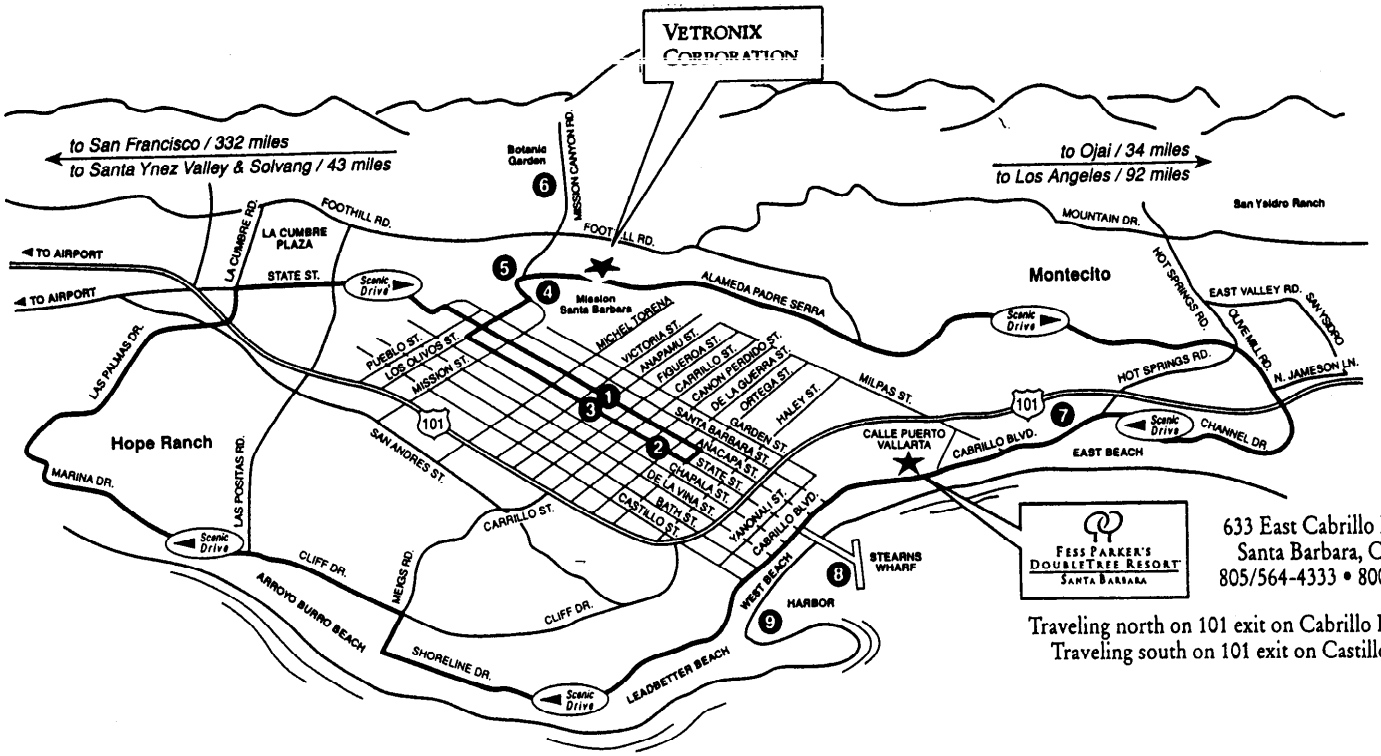
Best Western Beachside Inn
(805) 965-6556
336 W. Cabrillo Blvd.
Santa Barbara, CA 93103
(1 mile away)

Room Rates: **$129 - $199** per night

Best Western Carpinteria Inn
4558 Carpinteria Ave.
Carpinteria, CA
(10 miles away)

Room Rates: **$105** per night

City Map



633 East Cabrillo Boulevard
Santa Barbara, CA 93103
805/564-4333 • 800/879-2929

Traveling north on 101 exit on Cabrillo Boulevard
Traveling south on 101 exit on Castillo Street

1. SANTA BARBARA COUNTY COURTHOUSE
1100 block of Anacapa Street

Magnificent Spanish-Moorish "palace" surrounded by tropical gardens. Elegant interior; hand-painted ceilings, wrought iron chandeliers, giant murals, carved doors, imported tiles. Historical exhibits. Sweeping view from clock tower. Free tours, Wed & Fri 10:30am, Thu 2pm. Open weekdays 8am-5pm; Sat, Sun, holidays 9am-5pm. 962-6464.

2. EL PASEO-"The Street in Spain"
15 East De la Guerra Street

Picturesque shopping arcade reminiscent of Old Spain, built in and around the adobe home (1827) of the historic De la Guerra family. Richard Henry Dana described the spirited life at De la Guerra house in his classic book "Two Years Before the Mast." Charming import and specialty shops, art galleries, sidewalk cafe and dining courtyard. Cafe open daily; most shops from 10am. 965-0093

3. MUSEUM OF ART
1130 State Street

Outstanding small museum supported by art-minded citizens. Permanent exhibits include ancient sculpture, oriental art, an American collection. New visiting exhibitions always on display. Open Tue-Sat 11am-5pm (Free tours 2pm); Sun noon-5pm; Thu until 9pm; closed Mon 963-4364

4. MISSION SANTA BARBARA
Upper end of Laguna Street

Called "Queen of the Missions" for its graceful beauty. Take State St. to Los Olivos St., then four blocks toward the mountains. Founded 1786, tenth of 21 Franciscan missions in California. Still used as parish church. Beautiful setting overlooking city. Remnants of original water system on hill north of mission. Open daily 9am-5pm. Self guided tours of museum, garden, chapel, cemetery. 682-4713.

5. MUSEUM OF NATURAL HISTORY
Puesta del Sol Road (2 blocks north of the Mission)

Exhibits feature mammals, birds, fish, reptiles, plant life, geology of the Pacific Coast. Dioramas of prehistoric Indian life. Planetarium. Educational and enjoyable for all ages. Open 9am-5pm. Sun & holidays from 10am. 682-4711.

6. BOTANIC GARDEN
1212 Mission Canyon Road (1.5 miles north of Mission)

Sixty acres of native trees, shrubs, wildflowers, cacti in natural setting. Spectacular in spring. Three miles of easy-to-walk nature trails. Historic dam built in 1806 by Indians under direction of mission padres. Open daily 8am-Sunset. Guided tour Thu 10:30am, Sun 11am. Garden shop open 10am-4pm daily. Free admission. 682-4726.

7. SANTA BARBARA ZOOLOGICAL GARDENS
500 Ninos Drive off Cabrillo Boulevard (East of Milpas Street)

Zoo in delightful garden setting features elephants, lions, monkeys, sea lions, exotic birds and other animals, Miniature train ride, children's playground, botanical gardens. Snack bar and spacious picnic area. Farmyard area where children may pet and feed domestic animals. Open 10am-5pm daily, Summer 9am-6pm. train rides. 962-6310

8. STEARNS WHARF
Foot of State Street

Three-block-long extension of city's main street over the Pacific Ocean. Restaurants, shops, marine-related businesses and fishing pier. Oldest operating wharf on the West Coast. Open daily 7am-midnight. 963-2633.

9. YACHT HARBOR and BREAKWATER
West Cabrillo Boulevard

Haven for 1200 working and pleasure craft created by man-made breakwater. Paved walkway on top of breakwater offers a fascinating half-mile walking tour around harbor. Yacht Club, Harbormaster's office, restaurants and supply store. Departure point for tour boat and sport fishing excursion boat. Launch facilities. Boats for rent or charter.

Things To Do

SUN, SURF & SAIL...

Santa Barbara's coastline has something for everyone. Beach lovers will find sunbathing, sandcastle building, volleyball and swimming. If you're looking to conquer the ocean, try sailing, windsurfing or a leisure cruise. You can also charter a boat for deep sea fishing or tour the Channel Islands where you'll find unique plant and animal life. From December through April you can watch the whale migration past the Channel Islands.

ATHLETIC ADVENTURES...

We offer unlimited recreational activities of all types. Hit the courts for a game of tennis or basketball. Great golf courses are located throughout Santa Barbara like Sandpiper, just 15 minutes away with tees, fairways, and greens along the Pacific Ocean. For something a little more laid back play shuffleboard, practice putting on our putting green or go roller skating along the waterfront bike and skatepath. There's also horseback riding, hiking, or even hot air ballooning and polo nearby.

CITY SIGHTSEEING...

Santa Barbara's charm and culture abound... you won't want to miss any of it. The County Courthouse, a Spanish-Moorish masterpiece, is unlike any you'll ever see. Mission Santa Barbara, the Queen of California's Missions, is a tourist favorite. Stearns Wharf, the oldest operating wharf on the west coast, offers gift and souvenir shops, seafood stands, restaurants and other shops. Beautiful colors flourish in the Botanical Gardens and the Orchid Garden. The Santa Barbara Zoo is considered one of the nation's best small zoos. Be sure to visit Santa Barbara's museums and art galleries as well as State Street with all of its shops and eateries. Sight-seeing can also be done from open air trolleys operated by the Santa Barbara Trolley Company.

FESTIVALS & EVENTS...

Santa Barbara's year round activities provide diverse entertainment - Art Festivals, Danish Days, Greek Festival, Horse and Flower Show, International Film Festival, I Madonnari Street Painting Festival, Old Spanish Days Fiesta, Presidio Days, Pro and Celebrity Golf Tournaments, the Summer Solstice Parade and much more.

excursions

within a five-minute drive...

- Stearns Wharf, the oldest working wharf on the West Coast, housing restaurants, gallerias, and shops.
- Santa Barbara Zoological Gardens, featuring a variety of animals from around the world, a petting zoo, and a train ride.
- Golf at Montecito Country Club
- Whale watching. Watch the migration of the gray whales traveling north through the Santa Barbara Channel to feeding grounds in the Bering Sea.
- Shopping on State Street
- Yacht harbor and breakwater - has sailboat charters, fresh fish markets, seafood restaurants.

within a twenty-minute drive...

- Mission Santa Barbara, the Queen of the California Missions.
- Santa Barbara Courthouse, with mission-revival style architecture.
- El Paseo, originally an adobe rancho, now turned into a shopping enclave.
- Historical Society Museum, housing treasures from Santa Barbara's colorful past, covering three eras: Spanish, Mexican and American.
- Carriage Museum, housing a unique collection of horse-drawn carriages, some dating back over 300 years.
- Museum of Natural History, featuring mammals, birds, fish, reptiles, plant life and the geology of the Pacific Coast and Channel Islands.
- Sandpiper Golf Course, rated as one of the top 25 public courses in the U.S.

within a one-hour drive...

- Los Olivos, an up-and-coming art community, featuring galleries specializing in Western and Indian art.
- Solvang, a famous Danish community, offering shops, boutiques, and many wonderful bakeries.
- Santa Ynez wine country - over 30 wineries available for tours and evening events.
- Outlet Shopping at hundreds of stores at the Camarillo Factory Outlet Mall.